

eastward to the Gulf and south Atlantic coasts the minimum temperature was the lowest noted for June during the periods of observation. At Lynchburgh, Va., with a record of seventeen years, the minimum temperature for the current month was 4° below the lowest reading for June, which occurred in 1880; Charlotte, N. C., eleven years record, 7° below minimum of 1884; Charleston, S. C., seventeen years record, 6° below minimum of 1887; Augusta, Ga., seventeen years record, 11° below minimum of 1882; Savannah, Ga., nineteen years record, 8° below minimum of 1884; Jacksonville, Fla., eighteen years record, 8° below minimum of 1884; Cedar Keys, Fla., ten years record, 6° below minimum of 1884; Atlanta, Ga., eleven years record, 15° below minimum of 1879; Pensacola, Fla., ten years record, 9° below minimum of 1881 and 1888; Mobile, Ala., nineteen years record, 10° below minimum of 1888; Montgomery, Ala., seventeen years record, 9° below minimum of 1888; Vicksburg, Miss., seventeen years record, 1° below minimum of 1879; New Orleans, La., nineteen years record, 7° below minimum of 1879; Little Rock, Ark., ten years record, 4° below minimum of 1882; Chattanooga, Tenn., eleven years record, 12° below minimum of 1879; Knoxville, Tenn., nineteen years record, 3° below minimum of 1878; Memphis, Tenn., seventeen years record, 6° below minimum of 1888; Nashville, Tenn., nineteen years record, 2° below minimum of 1888; Louisville, Ky., seventeen years record, 5° below minimum of 1875; Indianapolis, Ind., sixteen years record, the same as minimum of 1885; Cincinnati, Ohio, eighteen years record, 9° below minimum of 1885; Columbus, Ohio, eleven years record, 2° below minimum of 1886; Sandusky, Ohio, eleven years record, 2° below minimum of 1888; Davenport, Iowa, eighteen years record, 4° below minimum of 1876 and 1882; Des Moines, Iowa, eleven years record, 6° below minimum of 1888; Keokuk, Iowa, eighteen years record, 2° below minimum of 1877; Cairo, Ill., eighteen years record, 4° below minimum of 1877; Springfield, Ill., ten years record, 1° below minimum of 1888; Saint Louis, Mo., nineteen years record, 1° below minimum of 1877. At Lava, N. Mex., with a record of five years, the temperature was 3° below the minimum of 1885, and at Montrose, Colo., five years record, 1° below minimum of 1888. In the lower lake region the absolute minimum temperature for June, for preceding years, occurred at most stations in 1879; in the Rio Grande Valley in 1877; in the extreme northwest in 1888; elsewhere the periods of occurrence were irregular.

RANGES OF TEMPERATURE.

The greatest and least daily ranges of temperature at regular stations of the Signal Service are given in the table of miscellaneous meteorological data. The greatest monthly ranges occurred in the upper Missouri valley, and in the Gila valley in south-central Arizona, where they exceeded 60°. From the Rocky Mountain and southern plateau regions and the upper Missouri valley the ranges decreased towards the oceans and the Gulf coast. The monthly ranges were least along the California coast and over the southern extremity of Florida, where they were less than 20°. On the coasts of North Carolina, Rhode Island, southern Massachusetts, and along the north Pacific coast the ranges were less than 40°.

The following are some of the extreme monthly ranges:

Greatest.		Least.	
Fort Custer, Mont.....	64.0	San Diego, Cal.....	16.0
Fort Buford, Dak.....	63.0	Key West, Fla.....	18.0
Fort McDowell, Ariz.....	62.0	Eureka, Cal.....	21.0
Breck, Utah.....	58.0	San Francisco, Cal.....	23.0
Pueblo, Colo.....	57.0	Block Island, R. I.....	24.0

FROST.

Frost was reported generally throughout the interior of the south Atlantic and east Gulf states and as far south as Bermuda, Ala., on the 1st. C. M. Witcher, at Point Peter, Ga., reports that the effect of the frost was plainly visible on cotton, corn, and peas. Damaging frosts were also reported in some parts of Iowa on the 1st, killing tender vegetables and retarding the growth of corn. Frost occurred most frequently in north-central Colorado, where, at stations, it was reported for nearly every date in the month. The occurrence of frost in June in the south Atlantic and east Gulf states, which, in localities, appears to have affected tender vegetation, is unusual if not unprecedented. Its occurrence attended the low temperature of that date, which, at a majority of the Signal Service stations in those districts, was the lowest recorded for June. The average dates of last damaging frosts for stations in the south Atlantic and east Gulf states occur in March. In Iowa, where at nearly all Signal Service stations the temperature was the lowest on record for June on the 1st, killing frosts were more than one month later than usual.

Frost was observed by dates during the month as follows: *Alabama*.—Bermuda, Motes, New Market, Valley Head, 1st. *Arizona*.—Belmont, 4th, 5th, 6th. *Colorado*.—Coulter, 1st to 20th; Frazer, 1st to 14th, 16th to 30th; Fort Collins, 4th; Palmer Lake, 8th, 10th; "B" Grand Lake, 1st to 30th. *Dakota*.—Spearfish, 2d; Gallatin, 3d, 4th, 15th, 16th. *Georgia*.—Atlanta, Marietta, Point Peter, 1st; Duck, 1st, 2d, 6th, 7th. *Iowa*.—Ames, Manson, Oskaloosa, Wesley, 1st; Hampton, 1st, 2d; Bancroft, 1st, 22d; Osage, 2d. *Kansas*.—La Harpe, 1st, 16th, 20th. *Michigan*.—Lansing, 23d. *Minnesota*.—Pokegama Falls, 22d. *Missouri*.—Glascow, Miami, Mexico, Savannah, 1st. *Montana*.—Sheldon, 6th, 14th, 24th. *Nebraska*.—Hay Springs, 4th. *Nevada*.—Carson City, 14th, 16th. *New Hampshire*.—Berlin Mills, 17th. *New York*.—Canton, Ilion, Middleburgh, Number Four, 7th, Arcade, 23d. *North Carolina*.—Lenoir, Mount Pleasant, 1st; Highland, 1st, 2d; Poland, 6th. *Ohio*.—New Athens, 1st; Wauseon, 4th; Greenville, Shanesville, Westerville, 6th. *Oregon*.—Fort Klamath, 23d, 24th. *Pennsylvania*.—Head Waters of Bob's Creek, 1st, 2d, 6th, 7th, 23d; Dyberry, Honesdale, 7th; Wellsborough, 23d, 24th; Philipsburgh, 24th. *South Carolina*.—Cedar Springs, 1st. *Tennessee*.—Chattanooga, Fayetteville, McMinnville, Nunnely, 1st. *Utah*.—Beaver, 9th, 10th, 11th; Nephi, 9th, 10th. *Vermont*.—Strafford, 7th; Coventry, East Berkshire, Northfield, 18th. *Wisconsin*.—Weston, 4th; Embarras, Fond du Lac, 5th; Friendship, 22d. *Wyoming*.—Cheyenne, 11th.

TEMPERATURE OF WATER.

The following table shows the maximum, minimum, and mean water temperature as observed at the harbors of the several stations; the monthly range of water temperature; and the mean temperature of the air for June, 1889:

Stations.	Temperature at bottom.				Mean temperature of air at the station.
	Max.	Min.	Range.	Monthly mean.	
Boston, Mass.....	63.0	54.8	8.2	58.9	60.2
Canby, Fort, Wash.....	67.5	58.0	9.5	62.1	55.6
Cedar Keys, Fla.....	90.1	73.1	17.0	84.3	76.6
Charleston, S. C.....	83.2	76.0	7.2	79.4	76.8
Eastport, Me.....	47.4	42.6	4.8	45.2	56.9
Galveston, Tex.....	85.0	75.0	10.0	81.3	79.0
Key West, Fla.....	88.9	76.0	12.9	85.0	80.8
Nantucket, Mass.....	73.5	55.0	18.5	67.3	63.6
New York City.....	68.2	58.4	9.8	64.2	70.4
Pensacola, Fla.....	83.5	72.0	11.5	79.6	77.2
Portland, Oregon.....	74.7	67.9	6.8	71.0	66.0

PRECIPITATION (expressed in inches and hundredths).

The distribution of precipitation over the United States and Canada for June, 1889, as determined from the reports of over 2,000 stations, is exhibited on chart iii. In the table of miscellaneous meteorological data the total precipitation and the departure from the normal are given for each Signal Service station. The figures opposite the names of the geographical

ical districts in the columns for precipitation and departure from the normal show, respectively, the averages for the several districts. The normal for any district may be found by adding the departure to the current mean when the precipitation is below the normal and subtracting when above.

In June, 1889, the precipitation was greatest in areas covering north-central New York, north-central Pennsylvania, central and east-central North Carolina, central Florida, north-central Mississippi, south-central and central Illinois, eastern and central Texas, and from eastern Louisiana to northeastern Texas, where it exceeded ten inches. The only regular stations of the Signal Service reporting rainfall to exceed ten inches were Charlotte, Hatteras, and Raleigh, N. C., and Titusville, Fla., where 10.54, 11.91, 10.44, and 11.62 inches, respectively, were recorded. At stations within an area extending from the Gila Valley in southwestern Arizona northward to the California coast, between about latitude N. 35° to 37°, no precipitation was reported. Over a greater part of the plateau regions less than one-half inch fell. On the Pacific coast the precipitation was greatest from the mouth of the Columbia River northward along the coast of Washington Territory, where, at stations, it exceeded two inches.

The precipitation for June, 1889, was generally above the normal from the west Gulf states eastward to the south Atlantic states, and thence northward to the lower lake region, and northeastward to the Canadian Maritime Provinces, except at stations along the immediate Gulf coast from Galveston, Tex., eastward, within an elongated area extending from Wilmington, N. C., to Augusta, Ga., along the New Jersey and south New England coasts, and at stations on the coasts of Nova Scotia and New Brunswick. The rainfall was also above the average for the month in the central parts of the upper lake region, over the middle eastern slope of the Rocky Mountains, at stations in southern New Mexico and southeastern Arizona, in the Sacramento Valley, and at San Diego, Cal. In other districts the precipitation was generally below the normal. The greatest departures above the normal precipitation occurred in eastern and southwestern North Carolina, along the southeastern shore of Lake Ontario, and in west-central Mississippi, where they exceeded five inches, and amounted to 7.27, 6.64, 5.95, and 5.89 inches at Hatteras, N. C., Oswego, N. Y., Charlotte, N. C., and Vicksburg, Miss., respectively. The most marked departures below the normal precipitation were noted in northern Minnesota and in the valley of the Red River of the north, where they were more than three inches. The deficiencies exceed two inches from Minnesota westward over the northern portion of Dakota and the central and northern parts of Montana, in northern Missouri and adjoining parts of Missouri, Iowa, and Illinois, at Cleveland and Sandusky, Ohio, and on the extreme west coast of Florida.

In districts where the precipitation was in excess the average percentages above the normal were about as follows: New England, 2 per cent.; middle Atlantic states, 25 per cent.; south Atlantic states, 51 per cent.; Florida peninsula, 7 per cent.; east Gulf states, 8 per cent.; west Gulf states, 45 per cent.; Rio Grande Valley, 41 per cent.; Ohio Valley, 15 per cent.; lower lakes, 24 per cent.; middle eastern slope of the Rocky Mountains, 4 per cent.; and southeastern slope of the Rocky Mountains, 35 per cent. In districts where the precipitation was below the normal the percentages of the normal precipitation was about as follows: upper lakes, 92 per cent.; extreme northwest, 32 per cent.; upper Mississippi valley, 85 per cent.; Missouri Valley, 59 per cent.; northern slope of the Rocky Mountains, 50 per cent.; southern plateau region, 60 per cent.; middle plateau region, 21 per cent.; northern plateau region, 34 per cent.; north Pacific coast, 51 per cent.; middle Pacific coast, 86 per cent.; south Pacific coast, 50 per cent.

In the preceding month there was an excess of rainfall in New England, the lower lake region, the Ohio Valley, and the middle Atlantic states, and reports show that an excess was noted for those districts for the current month. In the

south Atlantic and Gulf states there was a marked deficiency in May, where for the current month there was an excess of rainfall. Over the northern portion of the country, from Minnesota westward to the Pacific coast and in the middle plateau and middle Pacific coast regions, the rainfall was in excess of the average during May, while for June there were marked deficiencies in those districts, more especially from the Columbia Valley eastward to Minnesota, and in the middle plateau region. On the middle Pacific coast the rainfall in May averaged about three and one-half times the normal amount, while for the current month it is below the average. The deficiency on the south Pacific coast and in the southern plateau region continues.

DEVIATIONS FROM AVERAGE PRECIPITATION.

The following table shows for certain stations, as reported by voluntary observers, (1) the average precipitation for a series of years; (2) the length of record during which the observations have been taken and from which the average has been computed; (3) the total precipitation for June, 1889; (4) the departure of the current month from the average; (5) and the extreme monthly precipitation for June during the period of observation and the years of occurrence:

State and station.	County.	(1) Average for the month of June.	(2) Length of record.	(3) Total for June, 1889.	(4) Departure from average.	(5) Extreme monthly precipitation for June.			
						Greatest.		Least.	
						Am't.	Year.	Am't.	Year.
<i>Arkansas.</i>		<i>Inches</i>	<i>Years</i>	<i>Inches</i>	<i>Inches</i>			<i>Inches</i>	
Lead Hill.....	Boone.....	5.00	7	4.70	-0.30	7.14	1882	2.87	1888
<i>California.</i>									
Sacramento.....	Sacramento.....	0.13	39	0.28	+0.15	1.57	1884	0.00	*
<i>Colorado.</i>									
Fort Lyon.....	Bent.....	1.38	20	1.41	+0.03	4.08	1876	T.	1879
<i>Connecticut.</i>									
Middletown.....	Middlesex.....	4.72	27	3.34	-1.38	8.05	1862	0.49	1873
<i>Florida.</i>									
Merritt's Island.....	Brevard.....	7.24	11	14.28	+7.04	14.28	1889	3.32	1878
<i>Georgia.</i>									
Forsyth.....	Monroe.....	4.43	15	7.94	+3.51	11.14	1886	1.48	1879
<i>Illinois.</i>									
Peoria.....	Peoria.....	3.79	33	6.30	+2.51	11.18	1882	0.45	1863
Riley.....	McHenry.....	4.17	38	3.25	-0.92	9.68	1869	0.41	1863
<i>Indiana.</i>									
Logansport.....	Cass.....	4.22	16	4.79	+0.57	8.99	1882	0.55	1863
Vevay.....	Switzerland.....	4.68	23	4.46	-0.22	8.41	1875	1.36	1873
<i>Iowa.</i>									
Cresco.....	Howard.....	4.75	16	4.91	+0.16	9.34	1875	2.46	1887
Monticello.....	Jones.....	4.35	34	4.89	+0.54	9.02	1865	0.74	1857
Logan.....	Harrison.....	5.41	23	9.87	+4.46	10.61	1878	0.30	1870
<i>Kansas.</i>									
Lawrence.....	Douglas.....	5.10	23	4.04	-1.06	12.11	1876	1.30	1872
Wellington.....	Sumner.....	4.45	10	5.57	+1.12	7.71	1886	2.43	1887
<i>Louisiana.</i>									
Grand Coteau.....	St. Landry.....	5.82	6	4.90	-0.92	11.31	1886	2.50	1884
<i>Maine.</i>									
Gardiner.....	Kennebec.....	3.31	49	6.35	1859	0.65	1864
<i>Maryland.</i>									
Cumberland.....	Allegany.....	3.41	17	3.10	-0.31	5.84	1880	0.86	1885
<i>Massachusetts.</i>									
Amherst.....	Hampshire.....	3.76	52	5.40	+1.64	11.69	1862	1.38	1864
Newburyport.....	Essex.....	2.84	11	4.35	+1.51	5.94	1879	1.57	1880
Somerset.....	Bristol.....	3.10	17	3.13	+0.03	7.60	1875	1.29	1886
<i>Michigan.</i>									
Kalamazoo.....	Kalamazoo.....	4.85	13	4.94	+0.09	8.10	1883	1.78	1878
Thornville.....	Lapeer.....	3.99	12	2.38	-1.61	9.14	1883	1.92	1886
<i>Minnesota.</i>									
Minneapolis.....	Hennepin.....	4.36	23	1.53	-2.83	9.68	1874	1.53	1889
<i>Montana.</i>									
Fort Shaw.....	Lewis & Clarke.....	1.95	19	0.60	-1.35	4.98	1879	0.20	1876
<i>New Hampshire.</i>									
Hanover.....	Grafton.....	3.47	47	3.61	+0.14	7.27	1838	0.73	1864
<i>New Jersey.</i>									
Moorestown.....	Burlington.....	3.86	26	3.44	-0.42	7.56	1867	1.61	1864
South Orange.....	Essex.....	3.40	17	3.54	+0.14	6.02	1884	1.00	1885
<i>New York.</i>									
Cooperstown.....	Otsego.....	4.20	35	5.95	+1.75	9.76	1855	0.95	1870
Palermo.....	Oswego.....	3.24	35	7.17	+3.93	8.80	1865	0.70	1864
<i>North Carolina.</i>									
Lenoir.....	Caldwell.....	4.16	17	5.90	+1.74	10.30	1884	0.90	1881
<i>Ohio.</i>									
N. Lewisburgh.....	Champaign.....	3.93	17	3.80	-0.13	10.60	1877	1.05	1886
Wauseon.....	Fulton.....	4.20	17	3.69	-0.51	8.43	1881	1.43	1872
<i>Oregon.</i>									
Albany.....	Linn.....	1.68	10	0.55	-1.13	5.31	1888	0.22	1883
Eola.....	Polk.....	1.38	18	0.45	-0.93	5.06	1888	0.05	1883
<i>Pennsylvania.</i>									
Dyberry.....	Wayne.....	2.83	18	4.24	+1.41	5.38	1883	1.13	1873
Grampian Hills.....	Clearfield.....	4.38	17	3.71	-0.67	9.85	1884	1.31	1867
Wellsborough.....	Tioga.....	6.96	10	10.04	+3.08	17.47	1881	2.01	1886
<i>South Carolina.</i>									
Statesburgh.....	Sumter.....	3.27	8	5.10	+1.83	5.35	1886	1.38	1881

Deviations from average precipitation—Continued.

State and station.	County.	(1) Average for the month of June.	(2) Length of record.	(3) Total for June, 1889.	(4) Departure from average.	(5) Extreme monthly precipitation for June.			
						Greatest.		Least.	
						Am't.	Year.	Am't.	Year.
<i>Tennessee.</i>		<i>Inches</i>	<i>Years</i>	<i>Inches</i>	<i>Inches</i>	<i>Inches</i>		<i>Inches</i>	
Austin	Wilson	5.16	19	5.58	+0.42	8.92	1878	0.66	1874
Milan	Gibson	4.27	6	5.81	+1.54	8.81	1889	2.66	1887
<i>Texas.</i>									
New Ulm	Austin	3.92	16	6.31	+2.39	11.33	1873	0.51	1885
<i>Vermont.</i>									
Strafford	Orange	3.30	16	5.20	+1.90	6.30	1876	1.60	1884
<i>Virginia.</i>									
Bird's Nest	Northampton	3.29	20	5.25	+1.96	8.15	1881	1.00	1882
Wytheville	Wythe	3.85	24	8.08	+4.23	9.10	1875	1.30	1888
<i>Wisconsin.</i>									
Madison	Dane	4.09	19	2.00	-2.09	9.31	1880	1.08	1886
<i>Washington.</i>									
Fort Townsend	Jefferson	1.56	14	0.29	-1.27	4.10	1875	0.24	1886

*Frequently.

Table of excessive precipitation, June, 1889.

State and station.	Monthly rainfall to inches or more.	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		
		Am't.	Day.	Am't.	Time.	Day.
<i>Alabama.</i>	<i>Inches.</i>	<i>Inches.</i>		<i>Inches.</i>	<i>h. m.</i>	
Montgomery	2.67	14		2.53	1 03	14
<i>Arkansas.</i>						
Fulton	3.02	10				
Helena	2.58	14				
Hot Springs	4.00	29				
<i>Dakota.</i>						
Lead Hill				1.07	0 45	26
<i>Florida.</i>						
Armour				1.00	0 50	19
Onida				1.00	0 30	17
Spring Lake	3.00	25		3.00	1 15	25
Webster	3.90	17		3.90	2 45	17
<i>Georgia.</i>						
Alva	11.81	2.76	17			
Archer	3.25	17				
Fort Barrancas	3.19	26-27				
Fort Meade	3.45	16				
Homeland	3.75	16-17				
Key West	2.72	15-16				
Live Oak	10.12	2.50	29			
Manatee	11.10	3.63	16-17			
Mantanzas	3.38	15-16				
Meritt's Island	14.28	5.27	23	3.00	1 00	23
Do		3.73	24			
Saint Francis Barracks		3.05	15			
Titusville	11.62					
Villa City	11.26					
<i>Illinois.</i>						
Atlanta		3.00	29	1.05	0 40	19
Columbus	11.88	4.25	27	2.00	0 30	21
Diamond		2.83	27-28			
Duck		2.80	21			
Newnan		3.10	27-28	1.35	1 00	27
Savannah						
<i>Indiana.</i>						
Atwood	10.17					
Flora	11.49					
Pekin		3.25	7			
Peoria (1)		3.73	7	2.80	1 00	7
Peoria (2)		4.06	8			
Philo	11.16	4.25	7			
Richview	10.04			2.01	1 25	20
Windsor						
<i>Indian Territory.</i>						
Columbus		3.11	8			
Dana		2.56	8			
Marengo		3.00	8			
Rockville		2.60	7			
Shelbyville		2.60	8			
Worthington		3.31	8			
<i>Iowa.</i>						
Fort Reno		3.45	24			
Guthrie		3.15	16-17			
<i>Kansas.</i>						
Blakeville		3.00	8			
Clarinda				1.75	0 20	20
Eagle Grove		2.50	6			
Fayette		2.93	8-9			
Grinnell				1.30	1 00	26
Logan		3.55	15			
Do		3.15	20			
Muscataine (1)		3.50	16			
Muscataine (2)		2.62	15-16			
Sac City		3.00	6-7			
<i>Kentucky.</i>						
Atwood	10.03	3.00	9			
Elco		3.45	15			
Ellis		4.10	29			
Emporia		3.58	28			
Fort Scott		6.45	15-16			
Grenola		3.40	8-9			

Table of excessive precipitation—Continued.

State and station.	Monthly rainfall to inches, or more.	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		
		Am't.	Day.	Am't.	Time.	Day.
<i>Kansas—Continued.</i>	<i>Inches.</i>	<i>Inches.</i>		<i>Inches.</i>	<i>h. m.</i>	
Halstead	3.34	15				
La Harpe	2.65	16				
Lebo	2.90	15-16				
Marmaton	6.60	15-16				
McAllister	3.05	9				
Ogallah	2.50	29				
Stockton	3.00	8		2.00	1 30	8
Winfield	2.50	15				
<i>Kentucky.</i>						
Falmouth				1.85	1 30	30
Franklin				1.02	1 00	16
Louisville				1.14	1 00	27
<i>Louisiana.</i>						
Alexandria	14.58	3.79	10			
Do	4.68	19				
Do	3.02	30				
Baton Rouge	3.34	29-30				
Cheneyville	10.19	5.90	10			
Convent	10.95	2.91	10			
Crowley	15.51	5.56	6			
Jackson Barracks	2.80	27				
Lafayette	12.40	3.02	21			
Lake Providence	13.88	3.40	12			
Do	3.50	13				
Liberty Hill	10.35					
Marksville	10.33	2.50	10	1.50	1 10	19
Maurepas		3.00	30			
New Orleans	2.86	26				
Do	2.76	30				
Pointe à la Hache	11.86	3.00	26			
Port Eads		3.00	26			
<i>Massachusetts.</i>						
Amherst	2.68	11				
Nahant				1.34	1 15	5
Northampton	3.82	11				
<i>Michigan.</i>						
Albion	2.54	18				
Fort Mackinac	2.58	14-15				
Olivet	2.77	9				
Sand Beach	2.54	15				
<i>Mississippi.</i>						
Aberdeen	2.50	14				
Batesville	2.50	14				
Booneville	3.22	13				
Corinth	2.50	13				
Do	2.75	14				
Hazlehurst	3.00	30				
Hernando	3.40	14				
Lock Leven	3.64	29				
Louisville				1.59	0 30	17
Macon	2.80	29				
Okolona	2.60	13				
Rienzi	2.56	13				
Ripley	2.60	12				
Vicksburg	2.50	11-12				
Water Valley	2.50	14				
<i>Missouri.</i>						
Grand Pass	3.73	7-8				
New Frankford	4.60	7-8	2.60	1 30	29	
Do	2.60	29				
Willow Springs	3.20	26				
<i>Nebraska.</i>						
Oakdale	2.65	20				
<i>New Jersey.</i>						
Ocean City	2.70	1				
<i>New Mexico.</i>						
Los Lunas	2.62	21	2.62	1 45	21	
<i>New York.</i>						
Hess Road Station	12.13	2.61	26			
Madison Barracks	11.50	4.25	26-27			
Nineveh	12.10	3.75	17			
Oswego		2.77	1			
South Canisteo		2.50	17			
Tannersville		5.00	26-27			
Watervleit Arsenal	10.30					
<i>North Carolina.</i>						
Charlotte	10.54	2.79	30	1.97	0 52	29
Do				2.08	0 34	30
Hatteras	11.91					
Lumberton		2.68	28			
Ruleigh	10.44	5.18	28-29			
Wadesborough		3.00	28			
Weldon (2)	12.01	3.00	9			
Do		3.00	21			
Do		3.20	29			
<i>Ohio.</i>						
Akron				1.92	1 00	29
Ashland		2.54	30			
College Hill				2.00	2 00	28
Hiram				1.33	0 30	27
Sidney	2.60	18				
<i>Pennsylvania.</i>						
Erie	3.13	16-17				
Girardville	3.05	1				
Myerstown	2.68	21				
Nisbet	4.00	1				
Philipsburgh	3.26	1				
Tuscarora	2.55	1				
Wellsborough	10.04	7.45	1			
<i>South Carolina.</i>						
Charleston				1.12	1 00	27

Table of excessive precipitation—Continued.

State and station.	Monthly rainfall in inches, or more.	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		
		Amt.	Day.	Amt.	Time.	Day.
<i>South Carolina—Continued.</i>						
Timmons ville.....	<i>Inches.</i>	<i>Inches.</i>		<i>Inches.</i>	<i>h. m.</i>	
<i>Tennessee.</i>		2.61	29			
McKenzie.....		3.00	4			
Memphis.....		4.12	12-13	2.34	1 15	13
<i>Texas.</i>						
Belton.....	10.98	3.57	12			
Do.....		2.68	18			
Brownwood.....		2.57	25			
College Station.....		3.40	10			
Columbia Station.....		3.01	28			
Dallas (1).....		3.00	30			
Dallas (2).....		2.64	30			
Decatur.....				2.12	2 00	9
Duval.....		2.50	18			
Fort Brown.....		3.56	22-23			
Fort Clark.....		2.50	29-30			
Houston.....	10.67	2.92	10			
Lampasas.....	12.65	4.26	12	3.08	2 20	30
Do.....		3.08	30			
Longview.....	12.31	2.60	4			
Do.....		3.30	10			
Luling.....		4.00	10			
New Braunfels.....		3.25	9	3.25	3 15	9
Rio Grande City.....				1.05	0 49	22
Tyler.....	10.27					
Waco.....		3.40	12			
<i>Vermont.</i>						
Coventry.....	12.35	4.75	9			
Newport.....		3.00	9			
<i>Virginia.</i>						
Smithfield.....		2.58	28-29			
Spottsville.....		4.10	28-29			
<i>Mexico.</i>						
Topo Chico.....		3.23	22	3.23	1 40	22
<i>United States of Colombia.</i>						
Colon.....	31.26	4.72	4			
Do.....		6.30	16			
Do.....		2.97	25			
Do.....		2.51	26			

* May 28th, received too late for May Review. † May 31 and June 1.

Monthly precipitation to equal or exceed ten inches was reported at nine stations in Louisiana, six stations in Florida, five stations in Texas, four stations in Illinois and North Carolina, four stations in New York, and one station each in Georgia, Kansas, Pennsylvania, and Vermont. In states and territories other than those named, precipitation to exceed ten inches was not reported for June, 1889. The heaviest rainfall reported was 15.51, at Crowley, La. At Merritt's Island, Fla., a depth of 14.28 was reported; at Lampasas, Tex., 12.65; at Coventry, Vt., 12.35, and at Hess Road Station, N. Y., and Weldon, N. C., 12.13 and 12.01, respectively. At other stations reporting excessive rainfall for the month the total depth varied from ten to twelve inches. At the Island of Dominica, West Indies, a total monthly rainfall of 44.36 inches was reported, and at Colon, United States of Columbia, a depth of 31.26 inches was noted. In June of preceding years precipitation to equal or exceed ten inches has occurred most frequently in Florida, where it has been reported for twenty-four years; in Missouri for seventeen years; in Iowa for sixteen years; in New York for fifteen years; in Illinois, Kansas, Louisiana, Ohio, South Carolina, and Texas for from ten to fourteen years, inclusive; in Alabama, Dakota, Georgia, Indiana, Michigan, Minnesota, Nebraska, New Hampshire, North Carolina, Pennsylvania, Tennessee, and Virginia for from five to nine years, inclusive, and in Arkansas, Colorado, Connecticut, Indian Territory, Maryland, Massachusetts, Mississippi, New Jersey, Rhode Island, Washington Territory, and Wisconsin for from one to four years, inclusive. In states and territories other than those named precipitation to exceed ten inches has not been reported for June for preceding years. On the Pacific coast this amount has been reported for June for one station and one year only, a depth of 10.28 inches being noted at Neah Bay, Wash., in 1888. Over the plateau and Rocky Mountain regions ten inches, or more, of rainfall for June have not been reported, save for Trinidad, Colo., where 12.83 inches were measured in 1878. Among notable monthly rainfalls reported for June are, 36.91 at Alexandria,

La., in 1886; 29.56 at Fort Pike, La., in 1843; 29.35 at Fort Pierce, Fla., in 1853; 28.86 at Fernandina, Fla., in 1864; 26.59 at Cheneyville, La., in 1886; 25.58 at Fort Myers, Fla., in 1853; 24.56 at Fort Scott, Kans., in 1845; 21.86 at Sylvan Park, Minn., in 1872; and 20.15 at Sing Sing, N. Y., in 1867. Exclusive of the instances cited, monthly precipitation to equal or exceed fifteen inches has been reported for six years in Florida and Iowa; for four years in Louisiana and Missouri; for three years in Georgia; for two years in Alabama, Illinois, Kansas, Nebraska, New York, Ohio, Tennessee, and Texas, and for one year in Arkansas, Indian Territory, Michigan, New Hampshire, Pennsylvania, South Carolina, and Virginia.

Precipitation to equal or exceed 2.50 inches in twenty-four hours was reported at the greatest number of stations, fifteen, in Texas; at thirteen in Kansas and Louisiana; at twelve in Mississippi; at eleven in Florida; at from five to ten, inclusive, in Georgia, Indiana, Iowa, New York, North Carolina, and Pennsylvania; and in from one to four, inclusive, in Alabama, Arkansas, Dakota, Illinois, Indian Territory, Massachusetts, Michigan, Missouri, New Jersey, New Mexico, Ohio, South Carolina, Tennessee, Vermont, and Virginia. In states lying east of the one-hundredth meridian, other than those named, and in the Rocky Mountain and plateau regions and on the Pacific coast no daily rainfall to equal or exceed 2.50 inches was reported, except at Los Lunas, N. Mex., where 2.62 inches fell in one hour and forty-five minutes on the 21st. Among the heavier daily rainfalls for the month were: 5.90, at Cheneyville, La., on the 10th; 5.27, at Merritt's Island, Fla., 23d; 4.75, at Coventry, Vt., 9th; 4.26, at Lampasas, Tex., 12th; 4.25, at Philo, Ill., and Diamond, Ga., 7th and 27th, respectively; and 4.10 at Ellis, Kans., 29th. At Marmaton, Kans., 6.60 inches fell on the 15th and 16th; at Tannersville, N. Y., 5.00 inches, on the 26th and 27th; and at Wellsborough, Pa., 7.45 inches fell on May 31st and June 1st. At Colon, United States of Colombia, a depth of 6.30 inches was reported on the 16th.

Precipitation to equal or exceed 2.50 inches in twenty-four hours in June has been reported most frequently in Missouri, where it has been noted for twenty-one years; in Texas for sixteen; in Florida and Kansas for fifteen; in Illinois for fourteen; in Dakota for thirteen; in New York, Ohio, Minnesota, and Nebraska for eleven; in South Carolina and Georgia for ten; in Alabama, Arkansas, Connecticut, Indiana, Louisiana, Massachusetts, Michigan, Mississippi, New Jersey, North Carolina, Pennsylvania, Tennessee, and Virginia for from five to nine, inclusive; in Colorado, Delaware, Indian Territory, Kentucky, Maine, Montana, New Hampshire, Rhode Island, Vermont, and Wisconsin for from one to four years, inclusive. Daily rainfall to equal or exceed this amount has not been reported in the Rocky Mountain and plateau regions, or on the Pacific coast, except in Montana and Colorado. Among the heavier daily rainfalls reported for preceding years are: 22.27, at Alexandria, La., 16th, 1886; 10.70, at Pensacola, Fla., 29th, 1887; 10.24 at Fort Griffin, Tex., 21st, 1879; 9.70, at Sour Lake, Tex., 18th, 1888; 8.75, at Clear Creek, Nebr., 1st, 1875; 7.50, at Nashua, Iowa, 14th, 1880; 7.40, at Little Rock, Ark., 28th, 1879; 7.39, at Salisbury, N. C., 10th, 1883; 7.03, at Wilmington, N. C., 30th, 1876; 7.00, at Fort McPherson, Nebr., 25th, 1868; and Columbia, Tex., 17th, 1888. Exclusive of the instances named, daily rainfall to equal or exceed five inches has been reported in Alabama in 1888, in Arkansas and Ohio in 1877, in Dakota, Iowa, and Massachusetts in 1875, in Florida in 1879, in Illinois in 1874 and 1888, in Kansas in 1876 and 1878, in Kentucky and Louisiana in 1878, in Mississippi in 1886, in Missouri in 1848, in North Carolina in 1876 and 1885, in South Carolina in 1885, and in Texas in 1878 and 1884.

Rainfall to equal or exceed one inch an hour occurred on three dates in Dakota, Georgia, Kentucky, Texas, and Ohio; on two dates in Illinois, North Carolina, and Iowa; and on one date in Alabama, Arkansas, Florida, Kansas, Louisiana, Massachusetts, Mississippi, Missouri, New Mexico, South Carolina, and Tennessee. In the Rocky Mountain and plateau regions (except in New Mexico), on the Pacific coast, and in

the Lake region, middle Atlantic states, and New England, except in Massachusetts, rainfall to equal or exceed one inch an hour has not been reported. Among the heavier rainfalls reported for one hour or less are: 1.75 in twenty minutes, at Clarinda, Iowa, on the 20th; 2.00 in thirty minutes, at Diamond, Ga., 21st; 1.59 in thirty minutes, at Louisville, Miss., 17th; 2.08 in thirty-four minutes, at Charlotte, N. C., 30th; and 3.00 in one hour, at Merritt's Island, Fla., 23d. In June of preceding years rainfalls to equal or exceed this amount in the period given have been most frequently reported in Kansas, where they have been noted for eighteen years; in Georgia, Missouri, and Texas for thirteen years; in Nebraska for twelve years; in Illinois, Iowa, and Michigan for eleven years; in Dakota, Florida, Indiana, Louisiana, Minnesota, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, and Virginia for from five to ten years, inclusive; and in Alabama, Arizona, Arkansas, Colorado, Connecticut, Indian Territory, Maine, Maryland, Massachusetts, Mississippi, Montana, New Hampshire, New Jersey, New Mexico, New York, West Virginia, Wisconsin, and Wyoming for from one to four years, inclusive. In the middle and northern plateau regions and on the Pacific coast no rainfalls to equal or exceed one inch in one hour have been reported for June for preceding years. Among the heavier rainfalls reported for one hour or less in June are: 0.30 in three minutes, 5th, 1885; 0.44 in five minutes, 6th, 1883; and 0.50 in ten minutes, 29th, 1882, at New York City. 0.37 in five minutes, at Augusta, Ga., 27th, 1888. 1.19 in thirteen minutes, at Anna, Ill., 20th, 1878. For fifteen minute periods: 1.45, at Southington, Conn., 29th, 1879; 1.56, at Fort Randall, Dak., 28th, 1873; 1.75, at Portsmouth, Ohio, 22d, 1851; and 2.02, at Erie, Pa., 17th, 1886. 1.02 in twenty minutes, at Lynchburgh, Va., 15th, 1879. 1.20 in twenty-five minutes, at Indianapolis, Ind., 4th, 1885. For thirty minute periods: 2.02, at Denmark, Iowa, 25th, 1879; 2.00, at Boston, Mass., 29th, 1879; 2.00, at Alpena, Mich., 24th, 1880; 2.00, at Galveston, Tex., 17th, 1888; 1.84, at Missoula, Mont., 13th, 1875; and 2.00, at Keeswick, Va., 3d, 1881. 3.03 in thirty-five minutes, at Clear Creek, Nebr., 25th, 1882. 1.81 in thirty-one minutes, at Jacksonville, Fla., 26th, 1875; and 3.24 in forty-five minutes, at Dodge City, Kans., 19th, 1888.

MAXIMUM RAINFALLS IN ONE HOUR OR LESS.

The following is a record of the heaviest rainfalls during June, 1889, for periods of five and ten minutes, and one hour, as reported by regular stations of the Signal Service furnished with self-registering gauges:

Station.	Maximum fall in—						Maximum rate per minute.
	5 min.	Date.	10 min.	Date.	1 hour.	Date.	
	Inch.		Inch.		Inch.		Inch.
Boston, Mass.	0.15	5	0.25	5	0.50	5	0.03
Cincinnati, Ohio.	0.15	15	0.30	15	0.45	15	0.03
Chicago, Ill.	0.05	16	0.05	16	0.35	16	0.01
Detroit, Mich.	0.30	16	0.40	16	0.75	16	0.06
Dodge City, Kans.	0.09	24	0.16	24	0.65	24	0.02
Jupiter, Fla.	0.25	13	0.30	17	0.80	17	0.05
New York City.	0.25	17	0.30	17	0.35	17	0.05
Philadelphia, Pa.	0.10	15			0.50	26	0.02
Savannah, Ga.	0.40	9* 27	0.65	27	1.35	27	0.08
San Francisco, Cal.							
Saint Louis, Mo.							
Washington, D. C.	0.20	10	0.35	10	0.45	14	0.04

* Only 0.03 fell during the month.

† Self-register out of order.

This table shows that the greatest rate per minute of precipitation for a five minute period was .08 of an inch at Savannah, Ga., on the 9th and 27th. The rate per minute for this period at the other stations given was, .06 at Detroit, Mich., on the 16th; .05 at Jupiter, Fla., and New York City on the 13th and 17th, respectively; .04 at Washington, D. C., on the 10th, and .03 at Boston, Mass., and Cincinnati, Ohio, on the 5th and 15th, respectively. At Savannah, Ga., a rate of .065 of an inch per minute was maintained for ten minutes on the 27th, and .03 to .04 of an inch per minute fell for ten minute periods at Cincinnati, Ohio, Detroit, Mich., Jupiter,

Fla., New York City, and Washington, D. C., on the 15th, 16th, 17th, and 10th, respectively. Savannah, Ga., with a record of 1.35 inch in one hour on the 27th is the only station furnished with a self-registering gauge reporting rainfall to equal or exceed one inch an hour.

SNOW.

The following snowfalls have been reported for June, 1889: Georgetown, Colo., 8.5; Breckenridge, Colo., 6.0; Summit, Cal., 3.0; Alma, Colo., 0.5; Virginia City, Mont., and Cheyenne, Wyo., trace.

Laramie City, Albany Co., Wyo., 13th: snow fell all night and continued into the forenoon. Between Lookout, this county, and Rawlins, Carbon Co., nearly two feet of snow fell on the level. The snowfall in the mountains was very heavy. A snow storm so late in the season has not occurred in this section for many years.—*Northwestern Live Stock Journal*, Cheyenne, Wyo., June 14.

HAIL.

Descriptions of the more severe hail-storms of the month are given under "Local storms." Hail was reported during the month as follows:

1st, Colo., Pa., Vt. 2d, Kans., Nebr., Tex. 3d, Ariz., Kans., S. C., Tenn., Tex. 4th, Ill., La., Mo., Nev., N. Mex., N. Y. 5th, Ga., Mass., Nev., Tex. 6th, Iowa, Kans., Nebr., Nev. 7th, Ill., Iowa, Kans., Nebr. 8th, Ark., Colo., Ill., Kans., La., Mo., Tex. 9th, Mo., N. Y., Wyo. 10th, Me., Nebr., N. Y. 11th, Ala., Ill., N. Mex., Tenn. 12th, Nev., Tenn. 13th, Minn., Mo., Nev., Ohio. 14th, Kans., N. Y., Tenn., Wis. 15th, Ill., Kans., Md., N. Y., Pa., Tenn. 16th, Ky., N. Y. 17th, Dak., Kans., N. J., N. Y. 18th, Ky. 19th, Ind., Ky., La., Tenn. 20th, Ill., Mo. 21st, N. Y., Utah. 22d, Pa. 23d, Colo., Kans. 24th, Nebr. 25th, Dak., Kans., Minn., Mo. 26th, Iowa, Kans., Minn., Mo. 27th, Iowa, S. C., Tenn. 28th, Ind., Mass., Ohio. 29th, Kans.

THE FLOODS IN THE MIDDLE ATLANTIC STATES FROM MAY 31 TO JUNE 3, 1889.

These floods, which were probably the most destructive occurring within the United States of which we have record, originated within the limits of a barometric disturbance which had its origin to the west of the Mississippi. From the regular telegraphic reports of the Signal Service this storm has been traced from the central Rocky Mountain region to the Ohio Valley, where the disturbance divided on May 30th, the principal area of low pressure passing northward over the Lake region, while a secondary disturbance passed eastward over the Alleghanies in Virginia where it remained until the evening of the 31st. The unusual energy of this storm, developed in its advance over the Mississippi Valley, gave indications that the attending gales would extend from the Gulf coast northward to Lake Superior and along the Atlantic coast, and warnings had been previously issued by this service announcing the approach of these dangerous winds. On the morning of May 30th, when the disturbance was central in the Ohio Valley, the forecast was issued by this service announcing that severe local storms would occur in the middle and south Atlantic states and the Ohio Valley in the following twenty-four hours. The development of the secondary disturbance over Virginia, and its slow movement to the eastward, was attended by conditions favorable to continued heavy rains.

The distribution of pressure over the Atlantic Ocean between the twenty-fifth and fiftieth parallels was such as to occasion south to east winds along and off the coasts of the middle and south Atlantic states, where the normal wind-directions are from south to west. The pressure averaged considerably above the normal for May 30th, 31st, and June 1st, from the Azores westward to the New England coast and the Canadian Maritime provinces, the greatest average departures above the normal for the three days being shown in an area extending from Nova Scotia southeastward to about the thirtieth parallel, where they exceeded .30 of an inch. On the afternoon of the 31st the following announcement was made in the offi-

cial forecast of this service based upon the 8 p. m. report: "For eastern New York, eastern Pennsylvania, New Jersey, and Delaware, threatening weather and rain; cooler; south-easterly winds; destructive floods in the rivers of the Atlantic states. For Maryland and Virginia, rain, followed by clearing weather; variable winds; cooler; destructive floods in the rivers of the middle Atlantic states." These announcements were made in advance of the destructive floods, which were wholly due to the heavy rainfall in the river-sheds east of the Alleghanies; the warning being generally twenty-four hours or more before the occurrence of actual damage. Although the flood at Johnstown was most destructive, both as to life and property, it will be seen from the report of Professor Russell in the May REVIEW that probably not more than $\frac{1}{10}$ of the water that was in this flood came from the heavy rains, but was chiefly due to the breaking of the dam and the overflow of the waters of the reservoir.

Chart v which also accompanies his report exhibits the region visited by these floods, and shows the accuracy of the timely warning issued by this service, which warning, widely distributed through the associated press and by special telegrams, resulted in the saving of a large amount of property, but had full advantage been taken of the forecasts the loss of property would have been much less. The flooded district extended from southern Virginia to central New York.

Referring to the flood in Washington, Mr. Charles Wheatley, of Wheatley & Bros., lumber yard, states: "When we were warned by the Signal Office we put a force of men to work at once and secured everything by heavy ropes and other ways, and I find that we have scarcely lost anything." Many others took advantage of the warnings which were published in the city papers and thereby prevented loss of property.

A detailed statement of the enormous loss of life and property in the flooded districts would require more space than is available in this publication.

The following reports, received from observers in the flooded region, indicate its extent and unusual severity:

"Washington, D. C.: The waters of the Potomac rose higher (June 2d) than ever before known. At about noon the water had risen until the tide-gauges were hidden, and was fully three feet above the 1877 flood mark, and that was fully eleven feet above spring-tide high water. The streets and reservations on the lower levels in the centre of the city and all the wharves and streets along the river front were under water. Toward evening the water began to recede, and on the morning of the 3d the city had resumed something of its usual aspect. The flood caused great damage along the river front and on Rock Creek; the harbor improvements were injured and two spans of the Long Bridge were swept away. Serious, if not irreparable, damage was caused along the length of the Chesapeake and Ohio Canal, which was rendered entirely unnavigable throughout its entire length. Railroad communication with the south and west was cut off for two days. Considerable damage was caused to the machinery plants and material in the Navy Yard."

"Lynchburgh, Va., 1st: in consequence of high water produced by the heavy rains during the last three days, north-west of here as well as in the immediate vicinity of this city, nearly all the industrial establishments suspended operation last night. The flood in James River is unprecedented in height and volume since the great flood of 1870. All the bridges at this place have been swept away and the amount of damage done is very large."

"Harrisburg, Pa., 1st: the disastrous rain which prevailed throughout yesterday and last night ended at 4.40 a. m. to-day, 3.12 inches falling during the night. River rising rapidly, all bridges declared unsafe, travel suspended, and all the lower districts of the city are under water, reaching the second stories of the houses in many places. Losses in this city will amount to at least \$1,000,000. All manufactories have stopped operations, and the iron works are under water. The extreme height of the water in the Susquehanna River was reached at

9 p. m., rising in all 27.01 feet, 21.6 inches higher than the great flood of 1865, which was the highest point ever known here."

"Lewisburgh, Pa., 3d: the water in the west branch of the Susquehanna River is four feet above high-water mark of the great flood of 1855. Every bridge on the Susquehanna River from Sunbury, Northumberland Co., to Clearfield, Clearfield Co., has been swept away. At Williamsport, Lycoming Co., from fifty to eighty persons were standing on the bridge at Market street, which spans the Susquehanna River, when it gave away, plunging the people into the water. At Milton, Northumberland Co., the water stood five feet high in the streets. At this place five spans of the railroad bridge were swept away. The gas works, water works, and mills were flooded. The loss will reach \$75,000. Every town along the west branch of the Susquehanna River is isolated from every other town and communication is difficult, and between some places impossible."—*New York Tribune*, June 4.

"Elmira, Chemung Co., N. Y.: the water during the night of the 1st-2d was from 12 to 18 inches higher than ever before known. The Erie railway bridge was anchored in its place by two trains of loaded freight cars. The water rose to the cars, which, with the bridge, acted as a dam and forced the water back through the city, on the north side of the Chemung River, where the principal business houses are located. The water covered the streets to a depth of two or three feet, and the basements of the stores were quickly flooded, causing thousands of dollars damage."—*The Oswego, N. Y., Palladium*, June 3.

"Charleston, Kanawha Co., W. Va., 1st: the Big Kanawha River is dangerously high, and this place is in danger of being submerged. The Chesapeake and Ohio railroad bridge has been swept away. Tyrone, Blair Co., Pa., 1st: the Juniata River has overflowed its banks at this place and flooded the southern portion of the city, causing great damage."—*The Oswego, N. Y., Palladium*, June 1.

It has been estimated that the loss of life and property in the string of communities in the direct path of the Johnstown flood is about as follows:

	Life.	Property.
Johnstown and Millville.....	7,000	\$18,000,000
Pennsylvania Railroad.....		15,000,000
Franklin and East Conemaugh.....	38	1,200,000
Cambria.....	1,100	750,000
Woodvale.....	300	3,500,000
Kernville.....	600	300,000
Mineral Point.....	16	100,000
Minersville.....	8	15,000
Morrellville.....	1	10,000
Sheridan and Coopersdale.....	0	75,000
Total.....	9,063	38,950,000

The probable value of the property destroyed by these floods throughout the entire flooded district has been variously estimated at from \$50,000,000 to \$60,000,000.

The following extracts from a special report relative to these floods, by Professor Lorin Blodget, of Philadelphia, will be found of interest:

The floods of May 30, 31, and June 1, 1889, in Pennsylvania, Maryland, and Virginia.

It is undoubtedly proper to treat this flooded district as a whole, and to understand it properly the leading facts should be presented as they occurred on each successive day as fully as possible. In this way the extraordinary character of the storm and the flooding violence of the rainfall in each locality will be best shown.

There was a general storm developed in Kansas and Missouri May 27th, which moved slowly from west-southwest to east-northeast along a line from Kansas to New England, making this transit at a slower rate than usual, however, on and after a partial suspension on the 29th, developing renewed violence in Virginia and Pennsylvania on the 30th of May. This was the beginning of the extreme conditions, the high temperature and dense saturation, and it had been unusually cold both south and north up to the morning of the 30th.

As this saturated condition reached the higher ridges of the Alleghanies on this day, it developed the most excessive rainfall of the century for so large an area, depositing a uniform sheet of from 6 to 8 inches of rainfall during a continuous storm of from twenty-four to fifty-six hours duration. The greatest profusion was on May 31st and during the nights of May 30th-31st on the western border, and May 31st and June 1st on the eastern border. And this rainfall was in sheets or masses rather than in drops, being described as "cloud-bursts" by several observers and many local journals, a characteristic observed at Johnstown and Harrisburg alike, as also at places far south in Virginia and north as far as Smethport, McKean Co., Pa.

The winds were also peculiar, being light and unimportant on the first day (30th May), although generally from the south, southeast, or east. In all the mountain districts the wind continued light and almost falling off to calm at the close of the rain on the night of the 31st; but over all the southern and eastern areas affected by the storm, the southeast winds blew a gale from the first to the last; a large area over which no rain fell in southeastern Pennsylvania, Delaware, and New Jersey, having a southeast gale of twenty to forty miles an hour, and experiencing losses from this gale alone.

On the southern and eastern border the temperature was very high and there were many local storms of violence, especially in Virginia and Maryland. These were partially developed cyclones, but not as complete as those developed on the southeast line of the general storm of January 8-9th, last. The upper current or cloud mass in this case showed the most watery density from the first, and moved at a slow but uniform rate from a few points south of west, wasting as it passed eastward and at no time mingled with the scud borne on the southeast wind beneath.

It was quite remarkable that after the very heavy rainfall, usually an inch an hour for many successive hours, the wind fell off to a calm, and only a slight cooling and very light west wind followed the rain. It is also remarkable that a very small barometric movement attended the storm at the stations where barometers were kept, as unfortunately the interior stations of the State Weather Service were not supplied with barometers. At Pittsburgh the fall was about one-fourth of an inch only; also at Erie, at Harrisburg, and at Philadelphia. The pressure remained little below 30.00 inches throughout, and was scarcely affected by the southeast gales in southern and eastern Pennsylvania. There may have been barometric changes in the central area, having eight inches of rainfall, but there were no instruments there to record them. Further examination will be made to obtain an explanation of this anomaly.

The following events are condensed from all available sources for each successive day of the storm in this latitude:

May 30th: in some parts of western Pennsylvania and West Virginia the local disturbances were in the form of severe and even violent showers on this day. A southeast wind began in the early morning of May 30th at all the stations of the State Weather Service—at New Castle, Mercersburg (Thiel College), Indiana, Uniontown, and probably at Erie and Pittsburgh, not reporting on this point to the state service. Each station reported the threatening weather, and at Indiana there was rain on the 29th (1.2 inch) and on the 30th a fall of 2 inches. At Pittsburgh 1.5 inch, and at Johnstown 2.4 inches, were reported by an observer on the night of the 30th and morning of the 31st. At Somerset, 2,250 feet elevation, rain fell heavily during the evening and night of the 30th. At the stations next eastward, Charlesville, Hollidaysburgh, McConnellsburgh, and Huntingdon, the same southeast or southerly winds prevailed on the 30th, with a temperature of 70° and over, and rains at intervals after 4 p. m. In all Maryland, Virginia, and central Pennsylvania the day was hot, sultry, and threatening, with often occurring showers late in the afternoon, but otherwise favorable for the exercises of Decoration Day. This occasion fixed the time of rain beginning at nearly all the towns in the southern counties. In the northern and northwestern counties the rainfall was less, although generally threatening late in the day. The floods did not extend beyond Clarion in that direction.

In Clearfield, McKean, and Potter counties, however, the force of the storm was felt, beginning at Grampian Hills, Clearfield Co., at 4.30 p. m., and falling very heavily throughout the night; six inches in the seven hours after 12 p. m., as reported by the station observer there. At Emporium, Cameron Co., rain of two and a half inches after 9 p. m., and at Rimersburgh, Clarion Co., an equally marked flood. Evidently the entire line from southwest to northeast on the western heights of the Alleghanies had a flooding rain on the night of May 30th and morning of 31st. The west branch of the Susquehanna then got its first floods, the rain apparently falling equally over the southern and the northern tributaries of the west branch.

It is quite important to note this uniform development of threatening weather with southeast winds and heavy rain at nightfall along this extended line northward and also southward to the sources of the James River in Virginia. And this was everywhere attended with a development of high temperature not derived from the west.

May 31st: this day was marked by the most excessive and flooding rains all over the central counties of Pennsylvania. There is scarcely an exception to the uniformity of these conditions, and no material change even in the winds, as the following tabulated statements will show. The rainfalls were frequently described as "cloudbursts," and similarly expressive terms are found in the published reports. The duration of the rain is usually given as thirty-six hours. In the western and central parts of the state it ceased at 8 to 9 p. m. of the 31st, but in the eastern portions of the flooded counties it continued through the night to some early hour on June 1st.

There was no record of the quantity falling on the mountains proper, but all the indications point to a total on the more elevated surfaces of at least 8 inches, probably 10 inches on the ridges themselves. Over the whole area west of Harrisburg and from the state line on the south to McKean county on the north, the average fall of 8 inches gives, by a rough calculation, 480,000 tons to the square mile. Assuming this area to be approximately 60 by 200 miles, or 12,000 square miles, the total quantity would be 5,760,000,000 tons.

A violent gale from southeast prevailed over most of the surface of New Jersey during the entire day (May 31st), but there was very little rain, except upon the mountains of the northwestern part of that state. This gale alone is reported to have destroyed much property. It was also felt in most parts of Delaware and on the coast.

The following are the reported hours of beginning and ending of the heavier rainfalls, as reported chiefly at the stations of the Pennsylvania Weather Service:

State and station.	Began.	Ended.	Duration.
<i>West Virginia.</i>			<i>Hours.</i>
Charleston.....	Thursday, 12 m....	Friday, 11 p.m....	36
Piedmont.....	" 8 a.m....	Saturday, 1 a.m....	
Martinsburgh.....	" 8 a.m....	Friday.....	
<i>Virginia.</i>			
Fredericksburgh.....	" 10 p.m....	Saturday, 8 a.m....	34
<i>Pennsylvania.</i>			
Erie.....	" 10 p.m....	?	
Newcastle.....	" 3 p.m....	Friday, 7.30 p.m....	30
Uniontown.....	" 8.30 p.m....	" 3.30 a.m....	12
Pittsburgh.....	?	?	
Columbus (Warren).....	Thursday, 10 p.m....	?	
Johnstown.....	?	?	
Somerset.....	Thursday, 4 p.m....	Friday, 12 m....	33
McConnellsburgh.....	" 3 p.m....	?	
Bedford.....	" 3 p.m....	?	
Altoona.....	" 3 p.m....	?	
Chambersburgh.....	" 2 p.m....	Saturday, 3 a.m....	36
Huntingdon.....	" 4 p.m....	" 2 a.m....	36
Bendersville.....	" 3.30 p.m....	?	
Gettysburgh.....	" 3 p.m....	?	
York City.....	" 7 p.m....	Saturday, 5 a.m....	
Bellefonte.....	" 5 p.m....	?	
Lewistown.....	" 4 p.m....	Saturday, 2 a.m....	
Siglerville.....	" 3 p.m....	" 1 a.m....	
Yeagerstown.....	" 5 p.m....	" 2 a.m....	
Williamsport.....	" 9 p.m....	?	
Ralston (north of Williamsport).....	Friday, 1 a.m....	Saturday, 12 m....	32
Muncie (east of Williamsport).....	" 3 a.m....	" 1 p.m....	36
Emporium (Cameron).....	Thursday, 5 p.m....	Friday, 11.20 p.m....	32
<i>New York.</i>			
Buffalo †.....	" 8 p.m....	" 8 p.m....	24

*Same vicinity.

†1.3 inch.